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Ice-ocean interactions in the Greenland Sea Odden Region as Interpreted in
Ocean Mooring and Satellite Microwave Data

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Ocean convection is seen as a climatically important situation in which air-sea interactions influence oceanic circulation through the ventilation of deep and intermediate waters. A key site of convection, active in at least some winters, is in the Greenland Gyre, and the convection seems to be related to the development of an ice feature called Odden ("the Icy Cape" in Norwegian), an eastward extension of the ice edge in the latitude range 71° to 75°N. Previously published results showed a region of oceanic convection near the Odden ice edge at 75°N, 4°W in the 1988-89 winter. We have examined passive microwave data from SSM/I, SAR data from ERS-1, and ocean mooring data from the Greenland Sea Project for the period 12/88 to 3/89, and we have modeled the behavior of the ice edge driven by winds from the Norwegian hindcast dataset and air temperatures, recorded at Jan Mayen I and. in this paper we discuss the interpretation of passive microwave data to obtain data on the areal coverages of ice, the retreat rates of the ice as controlled, we assume, by the convective-return water, the ice growth rates and brine production as inferred from both environmental and satellite passive microwave data, and some interesting and somewhat speculative hypotheses regarding the behavior of plume, eddy, chimney, and polynya features in the microwave data sets. The principal finding from the large-scale passive microwave analysis of this study is that the Chimneys CVOI are and are transported by processes that are strongly wind-driven. In particular the open-water area that is taken to be the consequence of the return of warm, saline Arctic Intermediate Water (AIW) to the surface during convection is seen to move at the rate expected of either ice or surface water under wind-forcing. By contrast, recent numerical work, which has not included surface wind driving, has suggested that these features should circulate cyclonically with the gyre. The key dynamic elements of oceanic convection are the individual plumes, the clusters of plumes called chimneys, the eddies that are the consequence of chimneys aging in a rotating frame, and the polynyas resulting from the spread of AIW convective return water on the surface. The principal finding from the SAR analysis is that features can be observed which have scales consistent with those features except that the observed "plumes" seem to be 300-800 m across instead of the 1-2 km dimensions usually predicted.